

winian theory is being attacked more vigorously than ever; the assailants, however, belong to a very different class from Darwin's impetuous critics of the early 'sixties. Mr. Hird takes little or no notice of present-day problems, but writes as if the whole question of evolution still occupied the same position as in the mid-Victorian era. Within these limits he is fairly interesting; it is, however, unfortunate that he has admitted to his pages several inaccuracies that might with a little more care have been avoided. "Oasperm," "octoderm," are ugly misprints; "hermaphrodite" does not mean the same as "dioecious"; it is new to us that hæmatococcus "like the amoeba, requires to be magnified some 900 times in order to be seen." Huxley can scarcely be ranked as a "discoverer of evolution"; he would certainly never have made such a claim for himself. The illustrations in Mr. Hird's volume have mostly been seen before. Many of them are good, but the connection of some with the text is remote.

(2) Prof. Kellogg's book is of a very different stamp. So far from ignoring the questions that have in recent years grown up around the central doctrine of evolution, he has devoted an immense amount of labour to collecting, arranging, and expounding the views of nearly all the recent writers on evolutionary subjects. His treatise thus contains a vast quantity of material, in large part consisting of copious quotations from English, French, and German authors, put together somewhat promiscuously, and discussed without much exercise of the critical faculty, but useful to the student as a storehouse of various and conflicting opinions. The author's own standpoint is not very easily discovered. He passes in review the tenets of Darwinians, Lamarckians, Mutationists, Nägelians, with much appearance of giving a fair hearing to all sides. But as he seldom seems to know his own mind for long together, the general result is unsatisfying, not to say irritating; his impartiality is the impartiality of the pendulum rather than that of the judge. The author rightly appreciates the constructive weakness of anti-Darwinian arguments, but greatly overestimates their destructive efficiency. He allows, for example, far too much weight to frivolous objections such as those raised by Wolff in his "Beiträge zur Kritik der darwin'schen Lehre."

In examining the assaults delivered from various quarters on the Darwinian position, one cannot help being struck with the fact that the efforts of objectors tend much more effectively, on the whole, to refute each other than to weaken the defence. It is also quite obvious that to many of these critics Darwin's own writings are practically a sealed book. One cannot suspect Prof. Kellogg of talking about Darwin without having read him; nevertheless he shows, like other writers, a strange confusion of mind with respect to the Darwinian view of the function of natural selection in evolutionary process. Why should it be considered a "weakness" of the Darwinian theory of natural selection that this principle has "no influence whatever on the origin and control of variations"? Darwinism never professed to be an "all-sufficient explanation of adaptation and species-form-

ing" apart from the existence of variation, which fact it takes for granted. It is irrational to blame a theory because it does not explain one of the fundamental data from which it starts.

In at least one passage of his book, the author shows a distinct leaning towards the "orthogenesis" advocated by the school of Eimer. Theories, he thinks, of this general type "are directly in line with the spirit of modern biological methods and investigations." On this point, opinions will differ; we should be inclined to maintain the opposite. On a later page he advances what he considers to be "a logical proof for the introduction into phylogeny of adaptive ontogenetic changes," i.e. a proof of Lamarckism, for it is hard to see any distinction between this view and that of the French evolutionist.

"When species-differences and adaptations are identical with differences and modifications readily directly producible in the individual by varying environment, are we not justified," he asks, "on the basis of logical deduction, to assume the transmutation of ontogenetic acquirements into phyletic acquirements, even though we are as yet ignorant of the physicochemical or vital mechanism capable of effecting the carrying over?"

This question we should unhesitatingly answer in the negative. When rhetoric of the above description is dignified with the name of "proof," we are not surprised to find that the author's estimate of the true bearing of ascertained facts is feeble. It appears to cause him some astonishment that there still exist, "especially in England," thorough-going Darwinians who remain unmoved by the storm of criticism levelled against the theory of natural selection. That there are such stalwarts is undoubtedly the case, and the situation as maintained by them could not be better expressed than in the words, quoted without approval by Prof. Kellogg, of Sir E. Ray Lankester, at York, in August, 1906:—

"In looking back over twenty-five years it seems to me that we must say that the conclusions of Darwin as to the origin of species by the survival of selected races in the struggle for existence are more firmly established than ever."

F. A. D.

OUR BOOK SHELF.

Graphics, applied to Arithmetic, Mensuration, and Statics. By G. C. Turner. Pp. ix+388. (London: Macmillan and Co., Ltd., 1908.) Price 6s.

THIS work forms a valuable addition to the text-books on an important branch of mathematics, and, coming from a past student of Prof. Henrici, is especially welcome. Within the limits imposed by the author, the subject of graphics is very fully and ably treated. The first chapter, on graphical arithmetic, gives, at perhaps undue length, the geometrical constructions corresponding to the ordinary arithmetical processes, with the employment of scales and squared paper, and is followed by a very useful chapter on the graphical mensuration of plane figures. Vectors are then introduced, with examples of displacement, velocity, and acceleration vectors, and problems on mass centres—altogether a very interesting section. Experimental work is done in connection with concurrent forces in

chapter iv., and in verification of the properties of the link polygon and the equilibrium of a general system of coplanar forces in chapter v.

The principles of graphic statics, having thus been well laid and amply illustrated, are further developed in the succeeding chapters by practical applications, such as to stress diagrams for bridge and roof trusses, loaded at the joints, at intermediate points, and under wind pressures; to bending moments and shearing forces in beams, and the action of travelling loads; and to problems involving friction and work done by constant and variable forces.

While the deductive reasoning is well sustained throughout and satisfying to the logician, the subject is everywhere exemplified by concrete examples, fully worked out, and at short stages the student is provided with exercises in abundance, with answers, the author having drawn freely from the examination papers of the University of London, the Board of Education, the Civil Service Commission, and similar sources.

The very fulness with which graphic statics is discussed and illustrated in this volume makes one regret that some space could not have been found (by omissions, if necessary) for the equally important subject of graphic dynamics, founded on the vector conception of Newton's second law, with the application of the hodograph, and illustrations drawn from the motions of machines, the leading idea being to develop the fundamental law that force is vector rate of change of momentum. The author rightly emphasises the need for good-sized figures, and uses fairly large set-squares, in conjunction with straight-edge, scale and compasses, but he seems content with this comparatively meagre equipment, the incompleteness of which must surely handicap a student who does much quantitative graphical work.

With these reservations the book is admirable, and should do much to encourage the teaching of a subject that ought to form an integral part of the mathematical training given in our secondary and technical schools.

Man and his Future: A Glimpse from the Fields of Science. By Lt.-Col. William Sedgwick. Pp. 256. (London: T. Werner Laurie, 1907.) Price 7s. 6d. net.

This book is a curiously naïve attempt to justify and interpret in the light of modern scientific discoveries a somewhat old-fashioned form of orthodoxy. "The whole universe is the scene of a conflict between two powers over the possession of atoms of matter." This conflict is waged by means of the α - and β -rays of the physicist, which have respectively the power of "doing building work" with the atoms and of destroying the systems thus set up. Man is "a transgressing anthropoid ape" who, having wandered out of the regions where alone he could live in a state of nature, has purchased relief from his conditions by taking service with the Power of Repulsion—destroying the forests of the earth for fuel, and analysing compounds (such as ores) for their useful elements. But the growth of his needs has led him from mere destruction to synthesis, and so into the service of the Power of Attraction. Nevertheless, his original transgression condemns him still to destroy on earth, so that his synthetic activities—shown, for example, in chemistry, physics, and engineering—must be regarded as really "a training in the art of Universe-building," to be applied seriously only when the present cosmic order makes way for the New Evolution. Thus death is "a recruiting agency for the staff" to be engaged upon this gigantic re-constructive

operation, when they have re-clothed their "resting forms" in the protoplasmic garments for which the coal seams and the nitrate beds are perhaps intended to provide materials.

This work is so sincerely and modestly written that one regrets the necessity of saying that it can have but little value except to the student of the psychological history of discovery, who will note with interest and curiosity that, in connection with his "building-up" theory, Col. Sedgwick, in 1902, predicted the existence of non-valent elements having the atomic weights now actually assigned to the members of the helium group.

Développement et Progrès de la Fabrication du Malt pendant les quarante dernières Années. By Ed. Eckenstein. Pp. 212. (Paris: A. Hermann, 1908.) Price 5 francs.

THIS work gives an account of the development of methods of malting on the Continent from the time when the employment of mechanical appliances to supplement hand labour was first suggested to the present day, when, in some maltings, hand labour has practically disappeared. The author makes no attempt to discuss the progress of scientific knowledge in relation to malting, but confines himself almost entirely to a description of the manner in which the engineer has overcome many of the practical difficulties met with when attempting to deal with large bulks of germinating grain other than by hand labour. Problems such as the controlling of the heat generated by respiration of germinating grain in mass, and establishing an equal distribution of moisture throughout the individual corns of the mass, together with equal conditions of aëration, have to be solved. The solution of such problems by mechanical means is not easy, and there are still many competent critics, both in this country and abroad, who consider that the claim for success made by advocates of mechanical malting is not at present thoroughly well justified. However this may be—and the question is essentially a technical one—everyone interested in the progress of mechanical malting should read M. Eckenstein's book, the value of which is much enhanced by the numerous very excellent drawings and diagrams which it contains.

The Romance of the Sky; the Story of Star-gazing and Star-tracing, being an Introduction to the Study of Astronomy. By C. J. Griffith. Pp. viii+166. (London: George Routledge and Sons, Ltd.; New York: E. G. Dutton and Co.)

MR. GRIFFITH has undertaken to tell his story through the mouth of a mythical amateur astronomer, condemned to live through all the phases of astronomical science from pre-Ptolemaic days to the present. The method naturally introduces a great deal of reading matter that is not astronomy, but for non-astronomical readers the result, thus diluted, should prove of interest. A talk with Ptolemy, the enunciation of his great theory by Copernicus himself, the unfortunate reaction which delayed astronomical progress for centuries, and the final clearing of the mists by Kepler's results, occupy the first twenty pages. Then in rapid sequence Galileo, Newton, Halley, Herschel, and other notable workers in astronomy are interviewed, the volume concluding with discourses on the making of present-day observations and the deductions arising therefrom. The book is good, in parts, and the glossary of astronomical terms (chapter xxiv.), together with the excellent index, should not prove the least interesting or instructive to the beginner.

W. E. R.